Unit 04

CELLS AND TISSUES

Q.1. Define Microscopy. What do you know about first microscope?

Ans. Microscopy:

The use of microscope is known as microscopy.

First microscope:

The very first microscope was developed by Zacharias Janssen, in Holland in 1595. It was simply a tube with lenses at both ends and its magnification ranged from 3X to 9X.

Q.2. Explain important terms, which are used in microscopy.

Ans. Terms related to microscopy

Two important terms are used in microscopy:

(i) Magnification:

Magnification is the increase in the apparent size of an object and it is an important factor in microscopy.

(ii) Resolving power or resolution:

Resolving power or resolution is the measure of the clarity of an image. It is the minimum distance at which two objects can be seen as separate objects.

Resolution of human eye:

The human naked eye can differentiate between two points, which are at least 0.1mm apart. This is known as the resolution of human eye. Magnification and the resolution of human eyes can be increased with the help of lenses.

Q.3. Describe types of microscopes.

Ans. Two important types of microscopes used in microscopy are Light Microscope and Electron Microscope.

Light Microscope:

Introduction:

A light microscope works by passing visible light through a specimen.

Explanation

(i) Glass Lenses

It uses two glass lenses. One lens produces an enlarged image of the specimen and the second lens magnifies the image and projects it into the viewer's eye or onto photographic film. **(ii) Magnification**

Its magnification is 1500x

(iii) Micrograph

A photograph taken through a microscope is called a micrograph.

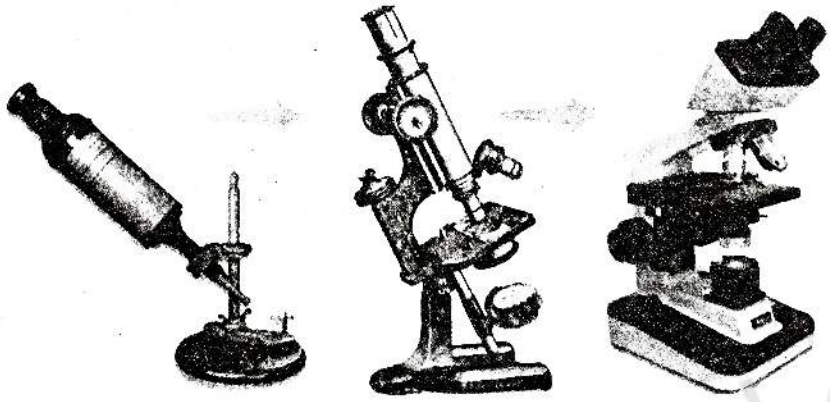


Figure 4.1: Light microscopes: From earlier (left) to the latest (right)

(iv) Resolving Power

Its resolving power is 0.2 micrometer (μm) and $1\mu m = \frac{1}{1000}$ mm. In other words, LM cannot resolve (distinguish) objects smaller than 0.2μm.

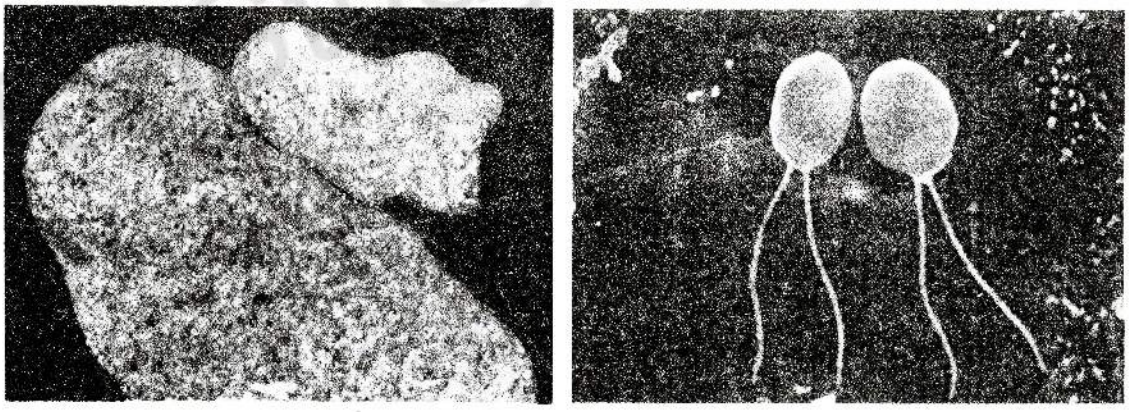


Figure 4.2: Light microscopic view; amoebae (left), unicellular algae (right)

Electron Microscope

Introduction

It is the most advanced form of microscope.

Explanation

(i) Working

In EM, object and lens are placed in a vacuum chamber and a beam of electrons is passed through object. Electrons pass through or are reflected from object and make image. Electro-magnetic lenses enlarge and focus the image into a screen or photographic film.

(ii) Resolving Power

The E.M has much higher resolving power than the LM. The most modern EM can distinguish objects as small as 0.2nanometer (nm) and $1nm = \frac{1}{1000,000} mm$.

(iii) Magnification

E.M can magnify objects about 250000 times.

(iv) Capability

EM can detect individual atoms, Cells, organelles and even molecules like DNA and proteins which are much larger than single atoms.

(iv) Types of Electron Microscopes

There are two types of electron microscopes.

(a) Transmission Electron Microscope (TEM)

(Lahore board 2011 G I)

In TEM, electrons are transmitted through specimen.

(i) Introduction

TEM is used to study the details of the internal cell structure.

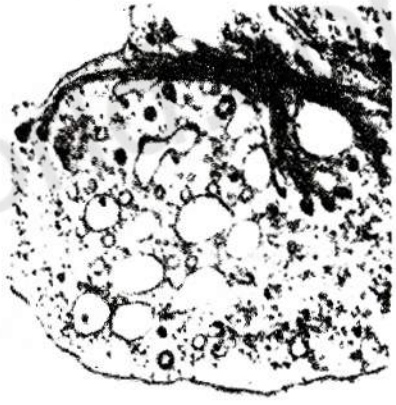


Figure 4.3: The TEM view of an animal cell

(b) Scanning Electron Microscope (SEM)

In SEM, electrons are reflected from the metal coated surfaces.

(i) Introduction:

SEM is used to study the structure of cell surfaces.

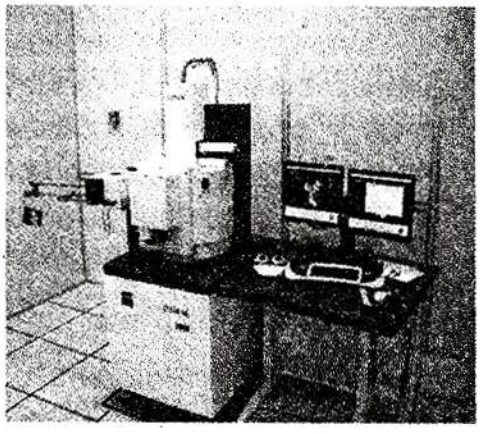


Figure 4.4: SEM (left) and view of mosquito's head and eye (right) through it

Q.4. Describe the history of the formulation of cell theory.

Ans. Greeks were the first who organized the data of natural world.

Aristotle

Aristotle presented the idea that all animals and plants are some how related.

Fundamental Unit – A Cell

But before microscopes were first used in 17th century, no one knew with certainty that living organisms do share a fundamental unit i.e. cell.

Robert Hooke

Cells were first described by a British scientist Robert Hooke in 1665. He used his self made light microscope to examine a thin slice of cork. Hooke observed a "honey comb" of tiny empty compartments. He called the compartments in the cork as "cellulae". His term has come to us as cells.

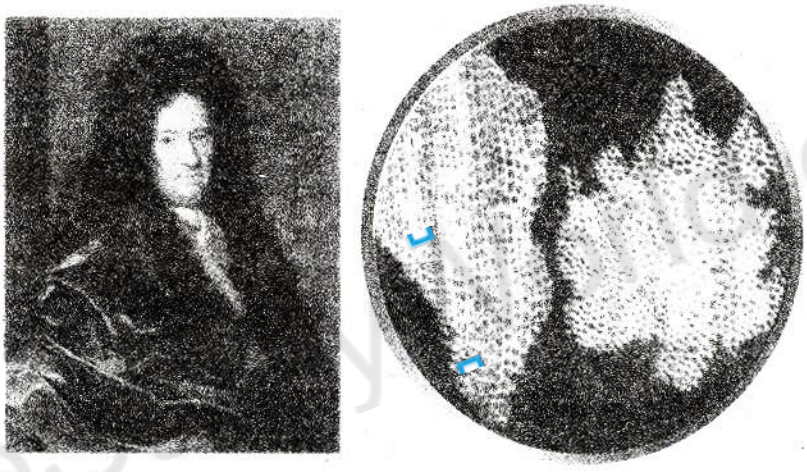


Figure 4.5: Robert Hooke was a chemist, mathematician and physicist.

His remarkable engineering abilities enabled him to invent and improve many Mechanical devices including time pieces, the quadrant and the Gregorian telescope. His observation about the section of cork is also illustrated here.

Antonie Van Leeuwenhoek

The first living cells were observed a few years later by Dutch naturalist Antonie Van Leeuwenhoek. He observed tiny organisms (from pond water) under his microscope and called them as "animalcules".

Jeans Baptist de-Lamarck

In 1809, Jeans Baptist de-Lamarck proposed that "no body can have life if its parts are not cellular tissues or are not formed by cellular tissues."

Robert Brown

In 1831, a British botanist Robert Brown discovered nucleus in the cell.

Schleiden and Schwann

In 1838, a German botanist Mathias Schleiden studied plant tissues and made the first statement of cell theory. He stated that all plants are aggregates of individual cells which are fully independent.

One year later, in 1839, a German zoologist Theodor Schwann reported that all animal tissues are also composed of individual cells.

Rudolf Virchow and Louis Pasteur

In 1855, Rudolf Virchow, a German physician, proposed an important extension of cell theory. He proposed that all living cells arise from pre-existing cells ("omnis cellula e cellula").

Louis Pasteur

In 1862, Loius Pasteur provided the experimental proof of this idea.

Salient features of Cell Theory

Cell theory was presented by Schleiden & Schwann. Cell Theory in its modern form, includes following principles;

(i) All organisms are composed of one or more cells.
(ii) Cells are the smallest living things, the basic unit of organization of all organisms.
(iii) Cells arise only by divisions in previously existing cells.

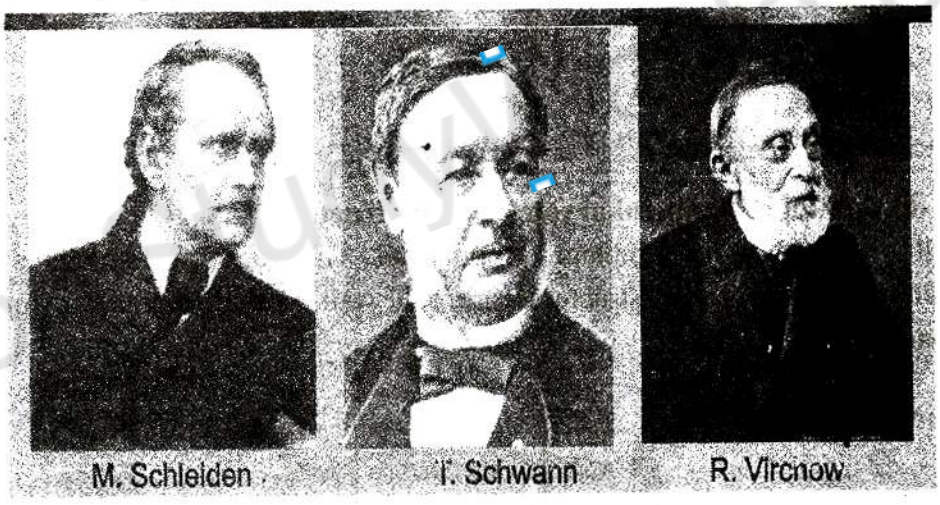


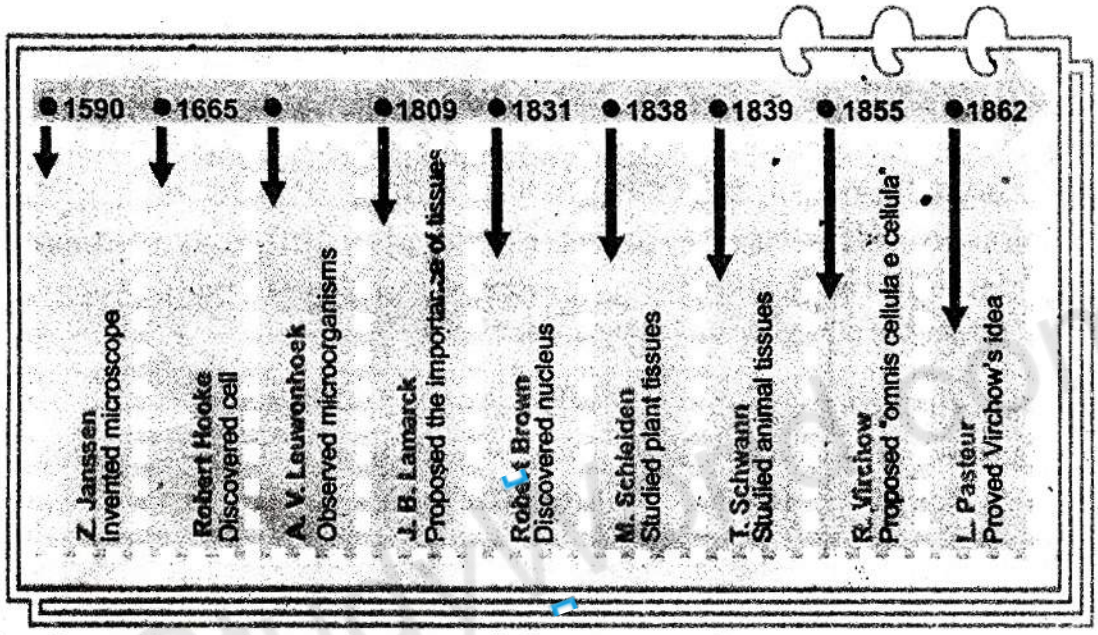
Figure 4.6: Three great German biologists

Q.5. What do you know about sub-cellular particles or a-cellular particles?

Ans. Viruses, prions and viroids are not composed of cells; rather they are sub-cellular particles or acellular particles which do not run any metabolism inside them. But they show some characteristics of living organisms i.e. they can increase in number and can transmit their characters to the next generations. These are not classified in any of the five kingdoms of organisms.

Q.6. Construct a time line that traces the history of formulation of the cell theory.

Ans.



Q.7. What do you know about eukaryote cellular structures?

Ans. A cell is made by the assemblage of organelles. There are some structures in the cell that are not organelles. These structures are cell wall, cell membrane, cytoplasm and cytoskeleton.

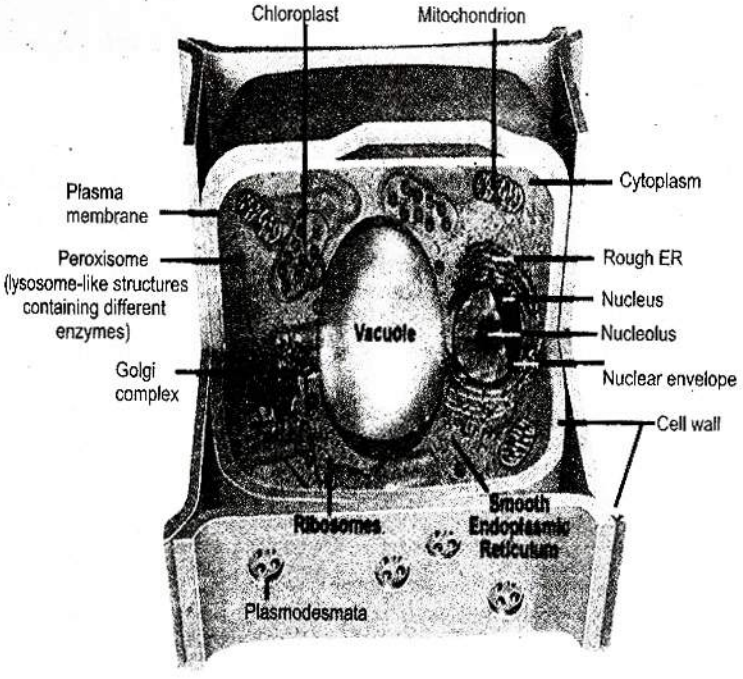


Figure 4.7: The ultra-structure of a plant cell

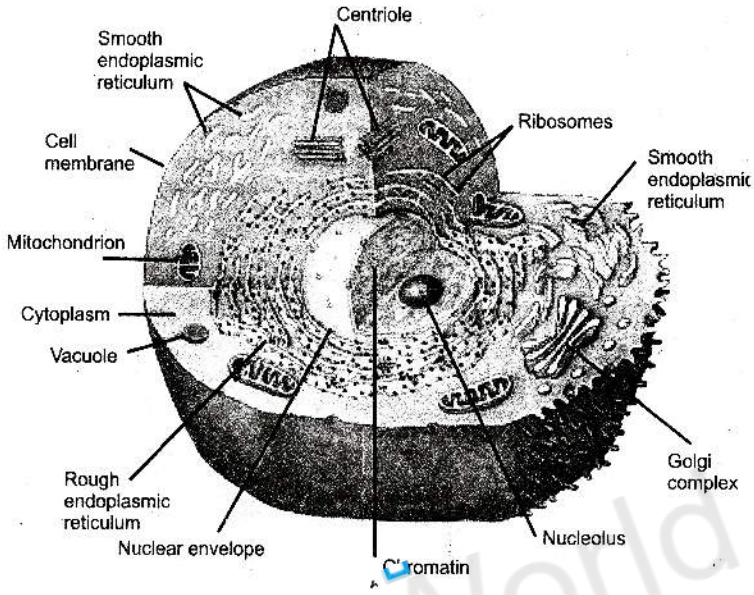


Figure 4.8: The ultra- structure of an animal cell

Q.8. Write a note on cell wall.

Ans. Cell Wall

Introduction

The cell wall is a non-living strong component of the cell and it is located outside the plasma membrane. Not all living organisms have cell walls around their cells e.g., animals and many animal like protists.

Function

It provides shape, strength, protection and support to the inner living matter (protoplasm) of the cell.

Chemical composition

Plant cells have a variety of chemicals incorporated in their cell walls.

Types

Primary wall **(Lahore board 2012 G II)**

The outer layer of the plant cell wall is known as primary wall and the cellulose is the most common chemical in it.

Secondary Wall **(Lahore board 2012 G II)**

Some plant cells, for example xylem cells also have secondary walls on the inner side of the primary wall. It is much thicker and contains lignin and some other chemicals.

Plasmodesmata

There are pores in the cell walls of adjacent cells, through which their cytoplasm is connected. These pores are called plasmodesmata.

Cell wall of fungi

Fungi and many other protists have cell walls although they do not contain cellulose. Their cell walls are made of variety of chemicals. For example, chitin is present in the cell wall of fungi.

Cell wall of prokaryotes

Prokaryotes have a cell wall composed of peptidoglycan that is a complex of amino acids and sugar.

Q.9. Write a note on cell membrane.

Ans. Cell Membrane

All prokaryotic and eukaryotic cells have a thin and elastic cell membrane covering the cytoplasm.

Function

Cell membrane functions as a semi permeable barrier, allowing a very few molecules across it while fencing the majority of chemicals inside the cell. In this way, the membrane maintains the internal composition of cell. In addition to this vital role, cell membrane can also sense chemical messages and can identify other cells etc.

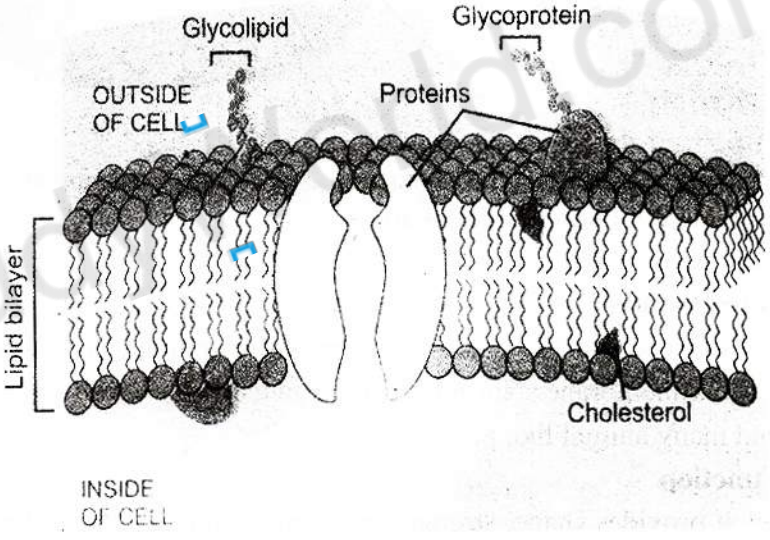


Figure 4.9: The fluid- mosaic model of cell membrane

Chemical composition

Chemical analysis reveals that cell membrane is mainly composed of proteins and lipids with small quantities of carbohydrates. Electron microscopic examinations of cell membranes have led to the development of the fluid mosaic model of cell membrane.

Fluid mosaic model

According to this model:

(i) Lipids

There is a Lipid bilayer in which the protein molecules are embedded. The lipid bilayer gives fluidity and elasticity to membrane.

(ii) Carbohydrates

Small amounts of carbohydrates are also found in cell membranes. These are joined with proteins or lipids of membrane.

(iii) Cholesterol

In eukaryotic cells, cholesterol is also present in lipid bilayer.

Eukaryotic cell

In eukaryotic cell, many organelles e.g. mitochondria, chloroplasts, golgi apparatus and endoplasmic reticulum are also bounded by cell membrane.

Q.10. Write a note on cytoplasm.

Ans. Cytoplasm

Definition

Cytoplasm is defined as the material between the plasma membrane (cell membrane) and the nuclear envelope. It is a semi-viscous and semi-transparent substance.

Chemical composition

The chemical analysis of cytoplasm reveals that it contains water which consists of;

(i) Organic molecules

Such as proteins, carbohydrates and lipids.

(ii) Inorganic salts

Inorganic salts are completely or partially dissolved.

Functions

The cytoplasm of the cell provides space for the proper functioning of the organelles and also acts as the site for various biochemical (metabolic) reactions. For example, Glycolysis (breakdown of glucose during cellular respiration) occurs in cytoplasm.

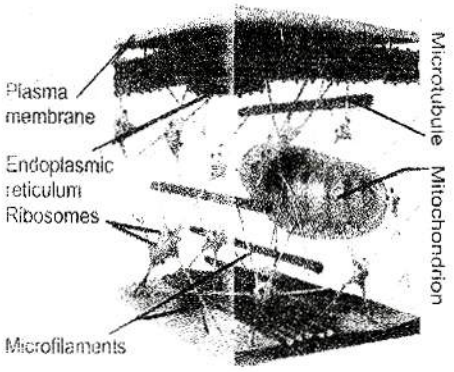


Figure 4.10: Cytoskeleton

Q.11. Write a note on cytoskeleton.

Ans. Cytoskeleton

Structure

Cytoskeleton is a network of microfilaments and microtubules.

Microtubules

Microtubules are made of tubulin protein and are used by cells to hold their shape. Microtubules are also major components of cilia and flagella.

Microfilaments

Microfilaments are made of actin protein. They help cells to change their shapes.

Q.12. Write a note on Nucleus. **(Lahore board 2011 G II)**

Ans. Nucleus

A prominent nucleus is present in eukaryotic cells.

Location **(Lahore board 2012 G II)**

In animal cells, it is present in the centre while in mature plant cells, due to the formation of large central vacuole, it is pushed to a side.

Nuclear membrane

The nucleus is bounded by a double membrane known as nuclear envelope. Nuclear envelope contains many small pores that enable it to act as a semi-permeable membrane.

Nucleoplasm

Inside the nuclear envelope, a granular fluid, i.e., the nucleoplasm is present. Nucleoplasm contains one or two nuecleoli (singular: nucleolus) and chromosomes.

Nucleolus

The nucleolus is a dark spot and it is the site where ribosomal RNA is formed and assembled as ribosomes.

Chromosomes

Chromosomes are only visible during cell division while during interphase (non-dividing phase) of the cell they are in the form of fine thread like structures known as chromatin. Chromosomes are composed of Deoxyribonucleic acid (DNA) and proteins.

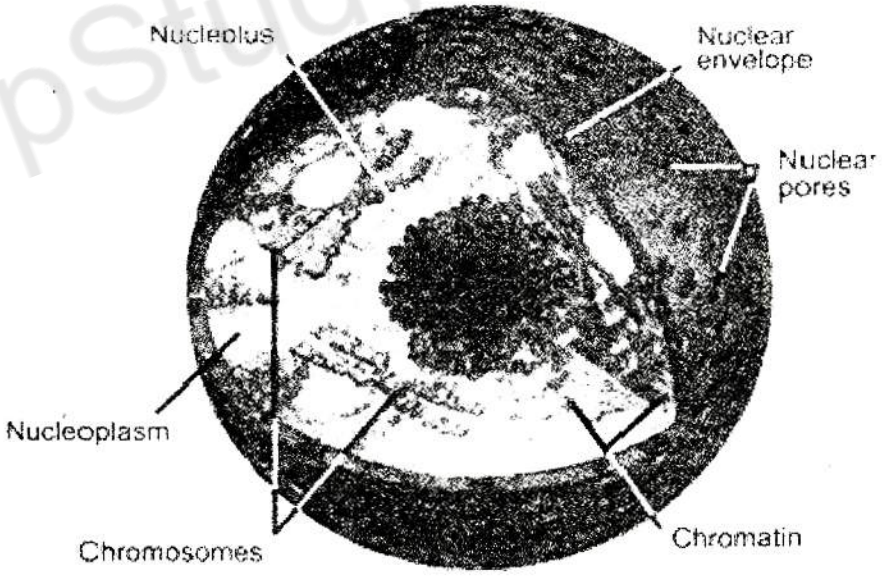


Figure 4.11: Structure of Nucleus

Nucleus of Prokaryotic cell

The prokaryotic cells do not contain prominent nucleus. Their chromosomes is made up of DNA only and is submerged in the cytoplasm.

Q.13. Write a note on Ribosomes.

Ans. Ribosomes

Ribosomes are the tiny granular structures that are either floating freely in the cytoplasm or are bound to the endoplasmic reticulum (ER).

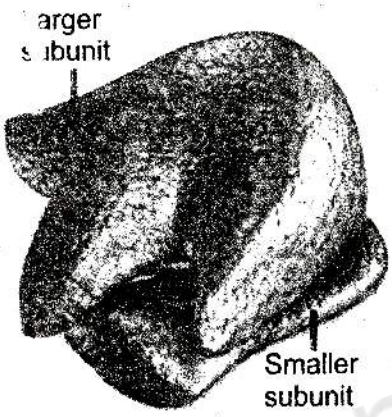


Figure 4.12: Ribosome

Structure

Each ribosome is made up of almost equal amounts of proteins and ribosomal RNA (rRNA). Ribosomes are not bounded by membranes and so also found in prokaryotes. Eukaryotic ribosomes are slightly larger than prokaryotic ones.

Function

Ribosomes are the sites of protein synthesis. Protein synthesis is extremely important to the cells and so large numbers of ribosomes are found throughout the cells. When a ribosome is not working, it disassemble into two smaller units.

Q.14. Write a note on Mitochondria.

Ans. Mitochondria

Introduction

Mitochondria (Singular: Mitochondrion) are the double membrane bounded structure found only in eukaryotes. Mitochondria is also called power house of the cell.

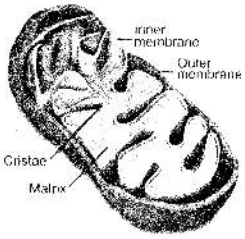


Figure 4.13: Mitochondrion

Structure

The outer membrane of mitochondria is smooth but the inner membrane forms many infoldings called cristae (singular crista) in the inner mitochondrial matrix. This serves to increase the surface area of the inner membrane on which membrane bound reactions can take place. Mitochondria have their own DNA and Ribosomes. The ribosomes of mitochondria are more similar to bacterial ribosomes.

Functions

These are the sites of aerobic respiration and are the major energy production centres.

Q.15. Write a note on Plastids.

Ans. Plastids

Definition

Plastids are also membrane bound organelles that only occur in the cells of plants and photosynthetic protists (algae).

Types

They are of three types.

(i) Chloroplasts

(ii) Chromoplasts
(iii)Leucoplast

Chloroplasts

Structure

Chloroplast is also bounded by double membrane. The outer membrane is smooth while the inner one gives rise to sacs called thylakoids. The stack of thylakoids is known as granum [plural grana] floating in the inner fluid of chloroplast i.e. the stroma.

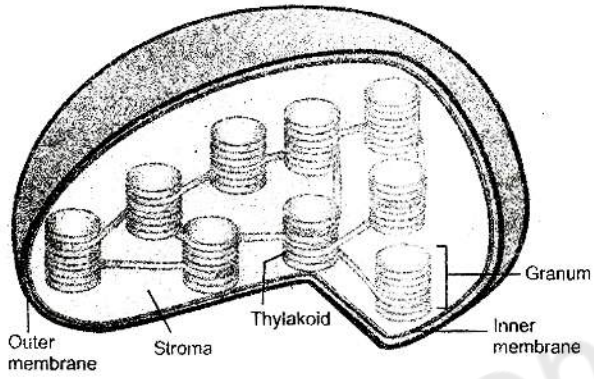


Figure 4.14: Structure of the chloroplast

Function

Chloroplasts are the sites of photosynthesis in eukaryotes. They contain chlorophyll, the green pigment necessary for the photosynthesis and associated accessory pigments. These pigments are present in the thylakoids of the grana.

Chromoplasts

Introduction

The second type of plastids in plant cells are chromoplasts. They contain pigments associated with the bright colours and are present in the cells of flower petals and fruits.

Function

Their function is to give colours other than green to these parts and thus help in pollination and dispersal of fruit.

Leucoplasts

Introduction

Leucoplasts are the third type of plastids. They are colourless and store starch, proteins and lipids.

Functions

They are present in the cells of those parts where food is stored.

Q.16. Write a note on endoplasmic reticulum.

Ans. Endoplasmic Reticulum

Endoplasmic reticulum is a network of interconnected channels that extend from cell membrane to the nuclear envelope. This network exists in two forms.

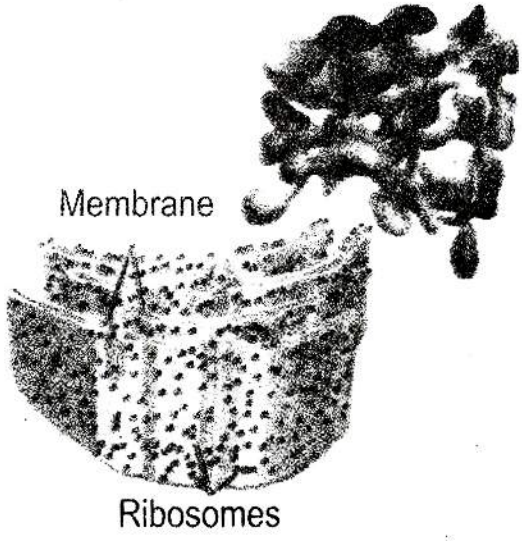


Figure 4.15: Smooth and Rough Endoplasmic Reticulum

(i) Rough Endoplasmic Reticulum (RER)

(RER) is so named because of its rough appearance due to the numerous ribosomes that are attached to it. Due to the presence of ribosomes, RER serves a function in protein synthesis.

(ii) Smooth Endoplasmic Reticulum (SER)

(SER) lacks ribosomes and is involved in lipid metabolism and in the transport of materials from one part of the cell to the other. It also detoxifies harmful chemicals that have entered the cell.

Q.17. Write a note on Golgi Apparatus.

Ans. Golgi Apparatus

Definition

An Italian physician Camillo Golgi discovered a set of flattened sacs (cisternae) in cell. In this set, many cisternae are stacked over each other. The complete set of cisternae is called Golgi apparatus or Golgi complex.

Occurrence

It is found in both plant and animal cells.

Function

It modifies molecules coming from rough ER and packs them into small membrane bound sacs called Golgi vesicles. These sacs can be transported to various locations in the cell or to its exterior in the form of secretions.

In 1906, Golgi was awarded Nobel Prize for physiology and medicine.

Figure 4.16: Camillo Golgi

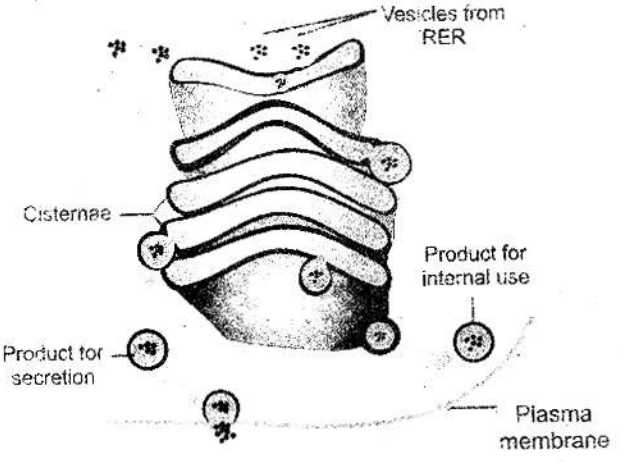


Figure 4.17: Functioning of the Golgi apparatus

Q.18. Write a note on Lysosomes.

Ans. Lysosomes

Introduction These are single membrane bounded organelles.

Discovery In the mid twentieth century, the Belgian scientist Christian Rene de Duve discovered lysosomes.

Function

Lysosomes contain strong digestive enzymes and work for the break down (digestion) of food and waste materials within the cell. During its function, a lysosome fuses with the vacuole that contains the targeted material and its enzymes break down the material.

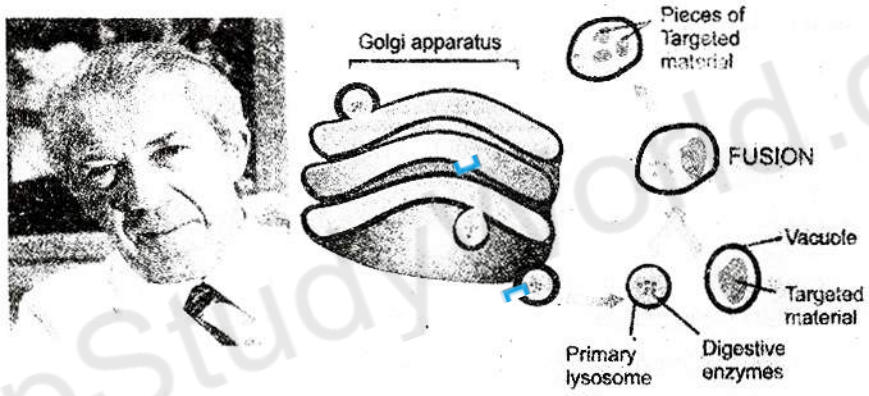


Figure 4.18: De Duve; Formation and Function of lysosome

Q.19. Write a note on Centriole.

Ans. Centriole

Definition: Animals and many unicellular organisms have hollow and cylindrical organelles known as centrioles.

Structure: Each centriole is made of nine triplets of microtubules made up of tubulin protein.

Location: Animal cells have two centrioles located near the exterior surface of the nucleus.

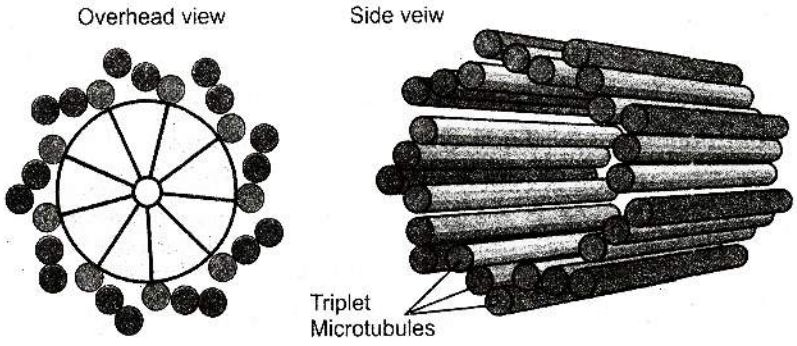


Figure 4.19: Structure of centriole

Centrosome: Two centrioles are collectively called a centrosome.

Function: Their function is to help in the formation of spindle fibres during cell division. In some cells, centrioles are involved in the formation of cilia and flagella.

Q.20. Write a note on vacuoles.

Ans. Vacoules

Definition

Vacoules are fluid filled single membrane bounded organelles.

Occurrence

Cells have many small vacuoles in their cytoplasm.

Function

When plant cells mature, its small vacuoles absorb water and fuse to form a single large vacuole in the centre. Fluid in this vacuole is called sap solution. Cells in this state become turgid. Many cells take in materials from outside in the form of food vacuole and then digest the material with the help of lysosomes.

Contractile Vacoule

Some unicellular organisms use contractile vacuole for the eliminations of wastes from their bodies.

Q.21. Describe the differences between prokaryotic and eukaryotic cells.

(Lahore board 2011 & 2012 G II)

Ans. Introduction

Prokaryotes possess prokaryotic cells which are much simpler than the eukaryotic cells.

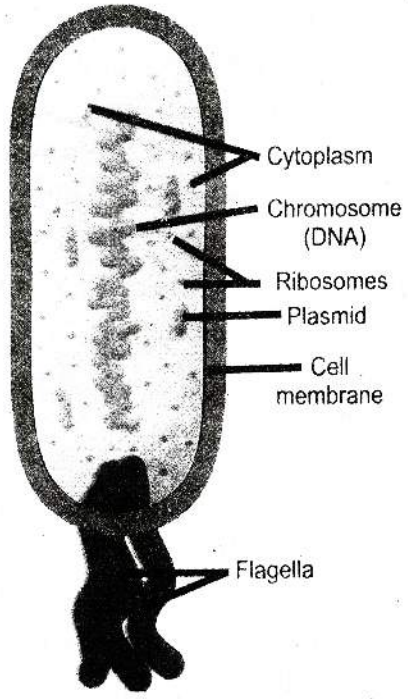


Figure 4.20: Structure of a generalized prokaryotic cell

Differences

(i) Prominent nucleus

Eukaryotic cells have prominent nucleus bounded by nuclear envelope while prokaryotic cells do not have prominent nucleus. Their chromosome consists of DNA only and it floats in cytoplasm near centre. This region is called nucleoid.

(ii) Membrane Bounded Organelles

Eukaryotic cells have membrane bounded organelles like mitochondria, golgi apparatus, endoplasmic reticulum etc. while such membrane bounded organelles are not present in prokaryotic cells.

(iii) Ribosomes

The ribosomes of eukaryotic cells are larger in size as compared to the ribosomes of prokaryotic cells.

(iv) Size

Eukaryotic cells are ten times larger than prokaryotic cells.

(v) Cell Wall

All prokaryotic cells have cell wall which is made of peptidoglycan (a large polymer of amino acids and sugar). The cell wall of eukaryotic cells is made of cellulose in plants or chitin in fungi.

Q.22. Describe the relationship between cell function and cell structure. (Lahore board 2011 G I)

Ans. Relationship between cell function and cell structure

The bodies of animals and plants are made up of different cell types. Human body is made of about 200 types of cells. Each type performs specific function and all coordinated functions become the life processes of the organisms. Cells of one type may differ from those of other types in following respects.

Size and Shape:	Red blood cells are round to accomodate globular haemoglobin.
	Nerve cells are long for the transmission of nerve impulse.
	Xylem cells are tube-like and have thick walls for conduction of water and support.
Surface area to volume ratio:	Root hair cells have large surface area for the maximum absorption of water and salts.
Presence or absence of organelles:	Cells involved in making secretions have more complex ER and Golgi apparatus.
	Cells involved in photosynthesis have chloroplasts.

Roles of Different Cells in Body

(i) Nerve Cells

Nerve cells conduct nerve impulse and thus contribute in coordination in body.

(ii) Muscle Cells

Muscle cells under go contraction and share their role in movements in body.

(iii) Red blood cells and white blood cells

Red blood cells carry oxygen and white blood cells kill foreign agents and so contribute in transportation and defence.

(iv) Skin Cells Some skin cells act as physical barriers against foreign materials and some as receptors for temperature, touch, pain etc.

(v) Bone Cells The cells of bone deposit calcium in their extracellular spaces to make the bone tough and thus contribute to the supporting role of the bones.

A cell works as an open system

Cells takes in substances needed for its metabolic activities through its cell membrane. Then it performs metabolic processes assigned to it. Products and by products are formed in metabolism. Cell either utilizes the products or transports them to other cells. The by-products are either stored or are excreted out of cell.

Q.23. Describe the relationship between cell size, shape and surface area to volume ratio.

Ans. Relationship between cell size and shape

Cells vary greatly in size.

Smallest Cells

The smallest cells are bacteria called Mycoplasmas with diameter between 0.1μm to 10μm.

Bulkiest Cells

The bulkiest cells are bird eggs.

Longest Cells

Longest cells are some muscle cells and nerve cells. Most cells lie between these extremes.

Relation of cell size and shape to cell function

Birds Egg

Bird's eggs are bulky because they contain a large amount of nutrient for the developing young.

Muscle Cells

Long muscle cells are efficient in pulling different body parts together.

Nerve Cells

Lengthy nerve cells can transmit messages between different parts of body.

Benefits of small cell size

Small cell size also has many benefits. For example human red blood cells are only 8μm in diameter and therefore can move through our tiniest blood vessels i.e. capillaries.

Surface area of large and small cells

Large cells have less surface area in relation to their volume while small cells of the same shape have more surface area. The figure shows relationship using cube shaped cells. The figure shows one large cell and 27 small cells. In both cases the total volume is the same:

Volume = 30μm × 30μm × 30μm = 27000μm^3

Contrast or Comparison of total volume to total surface area

In contrast to the total volume, the total surface area are very different because the cubical shape has 6 sides. Its surface area is 6 times the area of 1 side. The surface areas of the cubes are as follows.

Surface area of 1 large cube = 6 × (30μm × 30μm) = 5400μm^2

Surface area of 1 small cube = 6 × (10μm × 10μm) = 600μm^2

Surface area of 27 small cubes = 27 × 600μm^2 = 16200μm^2

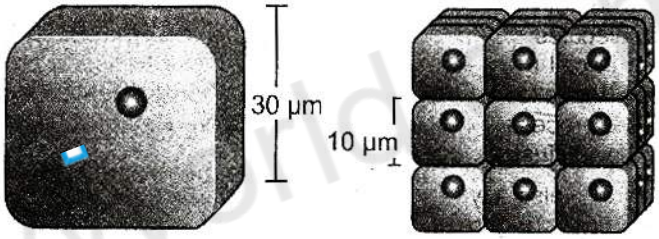


Figure 4.21: Effect of cell size on surface area

Role of Surface Area

The need of nutrients and rate of waste production are directly proportional to cell volume. The cell takes up nutrients and excretes wastes through its surface cell membrane. So a large volume cell demands large surface area. A large cell has much smaller surface area relative to its volume than smaller cells have. Hence it is concluded that the cell membrane of small cells can serve their small volumes more easily than the membrane of the large cell.

Q.24. Describe passage of molecules into and out of cells.

Ans. Introduction

Cell membrane acts as barrier to most molecules and is called semi-permeable membranes. Cell membranes maintain equilibrium inside and outside of cell by exchanging matter with cells and environment by following ways:

(i) Diffusion

Definition: Diffusion is the net movement of a substance from an area of higher concentration to area of lower concentration i.e. along a concentration gradient.

Explanation

1- Since the molecules of any substance (solid, liquid or gas) are in motion, when that substance is above 0 degree Kelvin or –273°C.

2- In a substance, the majority of the molecules move from higher to lower concentration.

3- There are some that move from low to high although the overall movement is thus from high to low concentration. Eventually, the molecules reach a state of equilibrium.

Importance

1- Diffusion is one principle method of movement of substances within cells, as well as across cell membrane.

2- CO_2, oxygen and glucose etc. can cross the cell membrane by diffusion.

3- Gaseous exchange in gills and lungs operates by this process.

4- Movement of glucose molecules from small intestine lumen into the blood capillaries of villi is another example of diffusion.

Passive Transport & Diffusion

Diffusion is a type of passive transport in which a cell does not expend energy when molecules diffuse across its membrane.

(ii) Facilitated diffusion

Definition

It is a type of diffusion which takes place with the help of transport proteins is called facilitated diffusion.

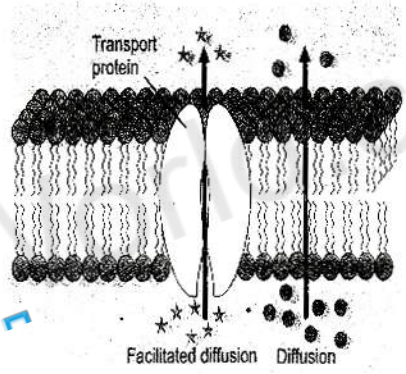


Figure 4.22: Diffusion and facilitated diffusion through cell membrane

Explanation

The molecules of some substances because of their size or charge cannot pass into or out of the cell through the cell membrane. This is brought about by certain protein called transport protein. The rate of facilitated diffusion is higher than simple diffusion. Facilitated diffusion is also a type of passive transport because there is no expenditure of energy in this process.

(iii) Osmosis

Definition Osmosis is the movement of water molecules across a semi-permeable membrane from a solution of lesser solute concentration to a solution of higher solute concentration.

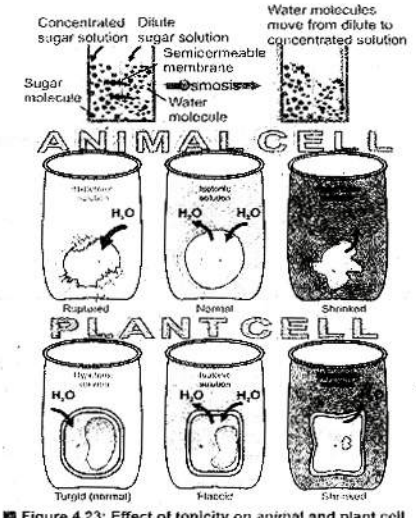


Figure 4.23: Effect of tonicity on animal and plant cell

Explanation (Concept of Tonicity)

The rules of osmosis can be best understood through the concept of tonicity of solutions.

Tonicity of Solutions

The term tonicity refers to the relative concentration of solutes in the solutions being compared.

Hypertonic solutions

A hypertonic solution has relatively more solute.

Hypotonic solutions

A Hypotonic solution has relatively less solute.

Isotonic solutions Isotonic solutions have equal concentrations of solutes.

Effect of tonicity on animal cells or Water Balance Problems in Animal Cells

Animal Cell in Isotonic Solution

When an animal cell i.e. red blood cell is placed in an isotonic solution the cell volume remains constant because the rate at which water is entering the cell is equal to the rate at which it is moving out.

Animal Cell in Hypotonic Solution

When a cell is placed in a hypotonic solution, water enters and the cell swells and may rupture like an over-filled balloon.

Animal Cell in Hypertonic Solution

Similarly an animal cell placed in a hypertonic solution will lose water and will shrink in size.

So in hypotonic environment (fresh water) animal cells must have ways to prevent excessive entry of water in hypertonic environment (sea water). They must have ways to prevent excessive loss of water.

Effect of tonicity on Plant cell or Water Balance Problem in Plant Cell

Plant Cell in Hypotonic Solution

When plant cell is placed in hypotonic environment, water tends to move first inside the cell and then inside the vacuole. When vacuole increases in size, cytoplasm presses firmly against the interior of the cell wall which expands a little. Due to strong cell wall, plant cells does not rupture but instead becomes rigid. In this condition the outward pressure on cell wall exerted by internal water is known as turgor pressure and this phenomenon is known as turgor.

Plant Cell in Isotonic Solution

In isotonic environment, the net uptake of water is not enough to make the cell turgid and it is flaccid.

Plant Cell in Hypertonic Solution

In a hypertonic environment, a plant cell loses water and cytoplasm shrinks. The shrinkage of cytoplasm is called **plasmolysis.**

(iv) Filtration

Definition

Filtration is a process by which small molecules are forced to move across semi-permeable membrane with the aid of hydrostatic (water) pressure or blood pressure.

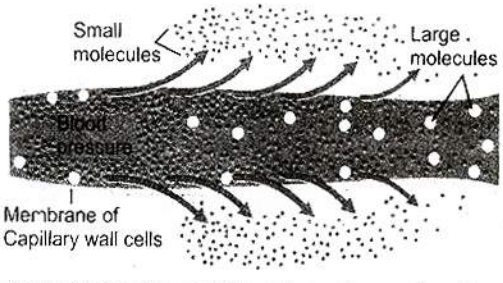


Figure 4.24: Filtration through the cell membrane of capillary wall

Example

In the body of an animal, blood pressure forces water and dissolved molecules to move through the semi-permeable membranes of the capillary wall cells. In filtration, the pressure cannot force large molecules such as proteins to pass through the membrane pores.

(v) Active Transport:

Definition:

Active transport is the movement of molecules from an area of lower concentration to the area of higher concentration. This movement against the concentration gradient requires energy in the form of ATP.

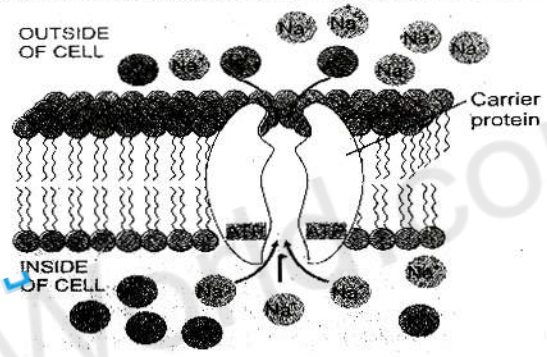


Figure 4.25: Sodium-potassium pump, showing active transport

Example:

The membranes of nerve cells have carrier proteins in the form of sodium potassium pump. In a resting (not conducting nerve impulse) nerve cell, this pump spends energy (ATP) to maintain higher concentrations of K^+ and lower concentrations of Na^+ inside the cell. For this purpose, the pump actively moves Na^+ to the outside of the cell where they are already in higher concentration and K^+ to the inside of the cell where they are in higher concentration.

(vi) Endocytosis

Definition

It is the process of cellular ingestion of bulky materials by the infolding of cell membrane.

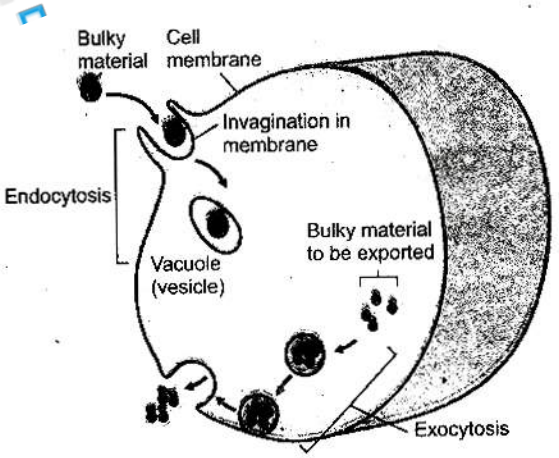


Figure 4.26: Endocytosis and Exocytosis

Forms of Endocytosis

There are two forms of endocytosis

(i) Phagocytosis (Cellular Eating)

(ii) Pinocytosis (Cellular Drinking)

In phagocytosis, cell takes in solid material while in pinocytosis cell takes in liquid in the form of droplets.

(vii) Exocytosis

It is the process through which bulky material is exported.

❖ This process adds new membrane which replaces the part of cell membrane lost during endocytosis.

Q.25. What are tissues and colony of cells?

Ans. Tissue

A group of similar cells specialized for the performance of a common function.

Colony of Cells

In a colony there are many cells and each cell performs all general functions on its own. Such a group does not get tissue level of organization because in cells coordination is absent.

Q.26. What is the role of turgor?

Ans. The turgor of cells is responsible for maintaining shapes of non-woody plants and soft portions of trees and shrubs.

Q.27. How does the tonicity of solution effect the guard cells?

Ans.

(i) Stomata

Stomata (openings) in leaf epidermis are surrounded by guard cells.

(ii) Opening of Stomata

During daytime, guard cells are making glucose and so are hypertonic than their nearby epidermis cells. Water enters them from other cells and they swell. In this form, they assume a rigid bowed shape and a pore is created between them.

(iii) Closing of Stomata

At night when there is low solute concentration in guard cells, water leaves them and they become flaccid. In this form, both guard cells rest against one another and the opening is closed.

Q.28. Describe application of knowledge about semi-permeable membranes.

Ans. Introduction

The knowledge about semi-permeable membrane is applied for various purposes.

(i) Separation of Substances

Semi-permeable membrane is capable of separating substances.

(ii) Separation of bacteria from viruses

Artificially synthesized semi-permeable membranes are used for separation of bacteria from viruses, because bacteria cannot cross a semi-permeable membrane.

(iii) Membrane Based Filtration Systems

In advanced water-treatment technologies, membrane-based filtration systems are used. In this process, semi-permeable membranes separate salts from water (reverse of osmosis).

Q.29. Describe different types of Animal Tissues.

Ans. Animal Tissues:

Animal tissues are of the following types.

1. Epithelial Tissues
2. Connective Tissues
3. Muscle Tissues
4. Nervous Tissues

(1) Epithelial Tissues **(Lahore board 2012 G I)**

Location

Epithelial tissue covers the outside of the body and lines organs and cavities.

Structure

The cells in this type of tissue are very closely packed together.

Types

This tissue has many types on the basis of the shape of cells as well as the number of cell layers.

(i) Squamous Epithelium

Structure:

It consists of a single layer of flat cells.

Location:

These are found in lungs, heart and blood vessels etc.

Function: They allow the movement of materials across it.

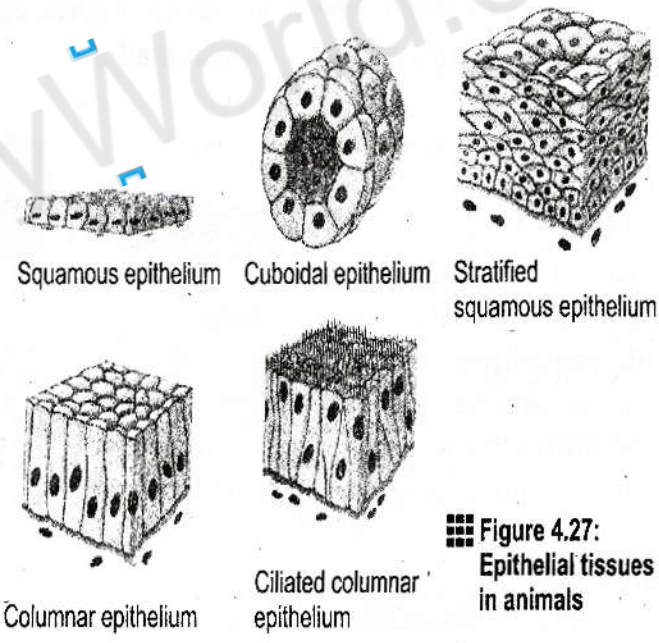


Figure 4.27: Epithelial tissues in animals

(ii) Cuboidal Epithelium

Structure

It consists of a single layer of cube-shaped cells.

Location

These are found in kidney tubes and small glands.

Function

It makes secretions.

(iii) Columnar epithelium

Structure

It consists of single layer of elongated cells.

Location: They are found in alimentary canal and gallbladder etc.

Function: It causes enzyme secretions.

(iv) Ciliated Columnar Epithelium

Structure They are elongated cells with cilia.

Location These are found in trachea and bronchi.

Function It propels mucous by ciliary action.

(v) Stratified Squamous Epithelium:

Structure

It consists of many layers of flat cells.

Location

These are found in the lining of oesophagus, mouth and also the skin.

Function

It protects the inner parts.

(2) Connective Tissues

As the name shows, connective tissues serves a "connecting" function.

Function

It supports and binds other tissues. Unlike epithelial tissue, connective tissue has cells scattered throughout an extracellular matrix.

Example

Common examples of this tissue are:-

i. Cartilage

(found around the ends of bones, in external ear, nose, trachea etc.),

ii. Bones. (hard connective tissue)

iii. The adipose tissue

(found around kidneys, under skin, in abdomen etc.) is also a type of connective tissue. It provides energy and support to the organs

iv. Blood.

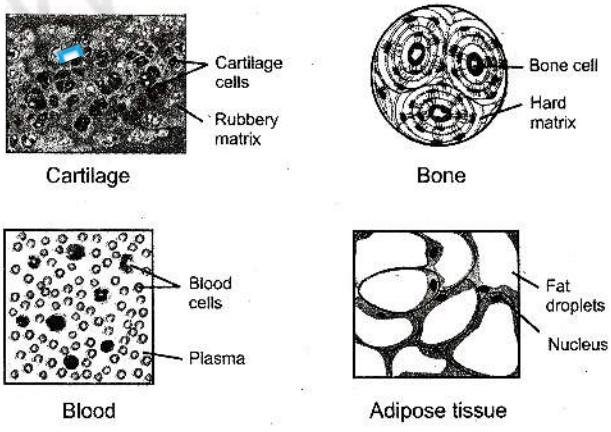


Figure 4.28: Connective tissues in animals

Blood is special type called semifluid connective tissue

(3) Muscle Tissue **(Lahore board 2012 G I)**

Structure

Muscle tissue consists of bundles of long cells called muscle fibres.

Function

The cells of this tissue have ability to contract.

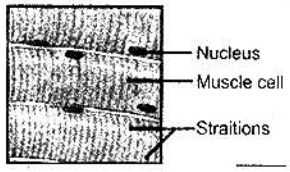
Types:

They are of three types:

(i) Skeletal Muscles

Structure

Their cells are striated (striped).



Skeletal muscles

Location

They are found attached to bones.

Function

They are responsible for the movements of bones. They are voluntary in action i,e. Their contraction is under the control of our will.

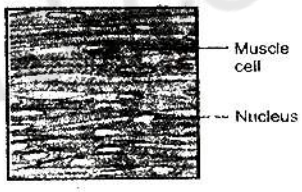
(ii) Smooth Muscles

Structure

They contain non-striated cells, each contains a single nucleus. They are involuntary in action i.e., their contraction is not under the control of our will.

Location

They are found in the walls of alimentary canal, urinary bladder and blood vessels.



Smooth muscles

Function

These are responsible for the movement of substances.

(3) Cardiac Muscles **(Lahore board 2012 G II)**

Structure

Their cells are also striated. They are involuntary in action. There is a single nucleus in each cell.

Location

They are found in the walls of the heart.

Function

They produce heart beat.

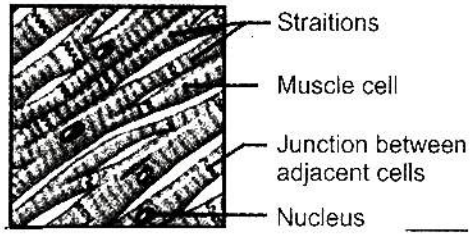


Figure 4.29 Types of muscle tissue

(4) Nervous Tissues

Structure

This tissue is mainly composed of nerve cells or neurons which are specialized to conduct messages in the form of nerve impulses.

Location

They are found in nerves, spinal cord and brain.

Function

They are responsible for communication among body parts.

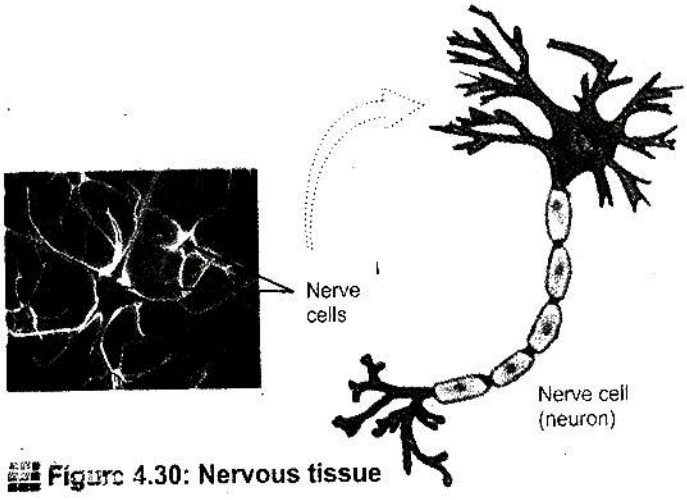


Figure 4.30: Nervous tissue

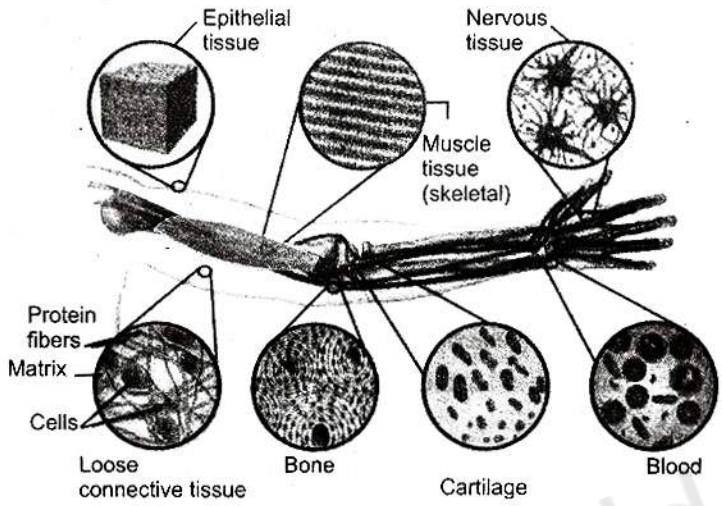


Figure 4.31: Different tissues in human body

Q.30. Describe the different types of plant tissues.

Ans. Plant Tissues

These are of two types:

1. Simple Tissues 2. Compound Tissues

(1) Simple Tissues

Definition The tissues which are made of single type of cells are called simple tissues.

Types They are further divided in the following types.

(i) Meristematic tissues

(ii) Permanent tissues

(i) Meristematic Tissues:

Introduction: These tissues are composed of cells which have ability to divide.

Characteristics:

(i) Cells are thin walled.

(ii) Having large nucleus

(iii)Small vacuole or no vacuole.

(iv)No inter-cellular spaces present in them.

Types There are two main types of meristematic tissues:

(i) Apical Meristems: **(Lahore board 2011 G II) (short question)**

They are located at the apices or tips of roots and shoot. When they divide they cause increase in the length of plant. Such a growth is called primary growth.

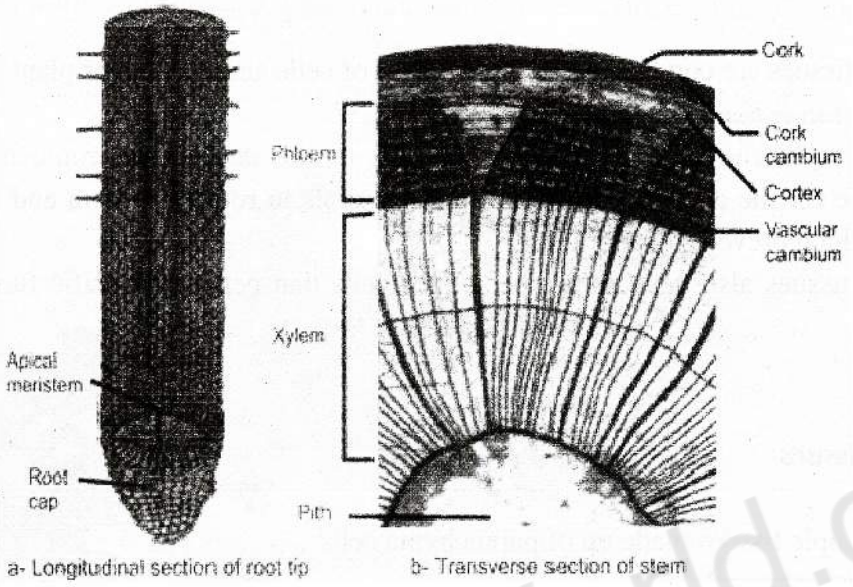


Figure 4.32: a-Apical meristem at root tip and b- Vascular and cork cambium in stem

(ii) Lateral Meristems:

Location

They are located on the lateral sides of roots and shoots.

Function

By dividing they are responsible for increase in growth of plant part. Such a growth is called secondary growth.

Types

They are further of two types i.e.

(a) Vascular cambium (b) `Cork cambium

(a) Vascular Cambium

Vascular cambium is present between the xylem and phloem tissue.

(b) Cork Cambium

Cork cambium is present in the outer lateral sides of plant.

(iii) Intercalary Meristem

It is in the form of small patches among the mature tissues. These are common in grasses and help in the regeneration of parts removed by herbivores.

(ii) Permanent Tissues

Introduction

Permanent tissues originate from meristematic tissues. These tissues are composed of cells, which do not have the ability to divide.

Types of Permanent Tissues

These are of the following types.

1. Epidermal tissues 2. Ground tissues 3. Support tissues

(1) Epidermal tissues:

Introduction

Epidermal tissues are composed of a single layer of cells and they cover plant body.

Functions **(Lahore board 2012 G I)**

They act as a barrier between the internal plant tissues and the environment. They are also responsible for the absorption of water and minerals in roots. On stem and leaves they secrete cutin which prevents evaporation.

Epidermal tissues also have some specialized cells that perform specific functions. For example

(i) Root Hairs

(ii) Stomata

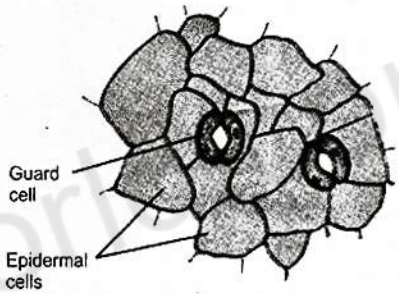


Figure 4.33: Epidermal tissue

(2) Ground Tissues

Introduction

They are simple tissues made up of parenchyma cells.

Shape: They are spherical.

Functions

❖ They have thin primary cell walls and have large vacuoles for storage of food.

❖ In the leaves, they have sites of photosynthesis and in other parts, they are the sites for respiration and protein synthesis.

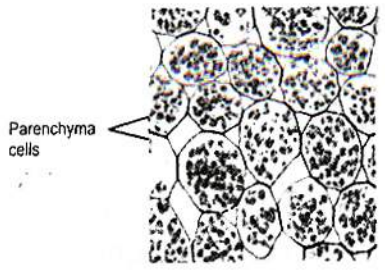


Figure 4.34: Ground tissue

(3) Supporting Tissues

Introduction

These tissues provide strength and flexibility to the plants.

Types: They are of two types:

(a) Collenchyma Tissues

Location

They are found just beneath the epidermis in the cortex of young herbaceous stems and in the midribs of leaves and in petals of flowers.

Structure

They are made of elongated cells with unevenly thickened primary cell walls. They are flexible.

Function: Their function is to support the organs in which they are found.

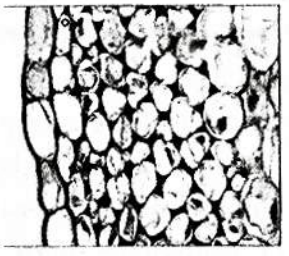


Figure 4.35: Collenchyma tissue

(b) Sclerenchyma

❖ They are composed of cells with rigid secondary cell walls.

❖ Their cell walls are hardened with lignin, which is the main chemical component of wood.

❖ Mature sclerenchyma cells cannot elongate and most of them are dead.

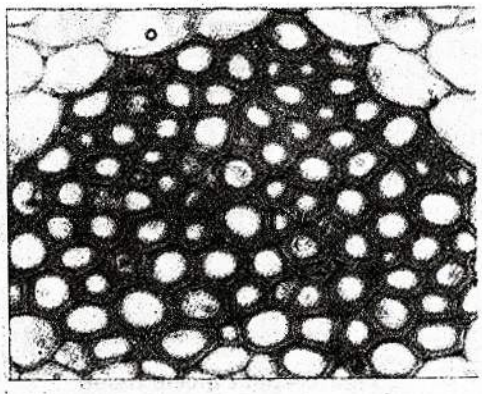


Figure 4.36: Sclerenchyma tissue

(iv) Compound (Complex) Tissues

Introduction A plant tissues composed of more than one type of cells performing a common function is called compound or complex tissues e.g., xylem and phloem tissues.

Xylem Tissues

Functions

❖ Xylem tissue is responsible for the transport of water and dissolved substances from roots to aerial parts.

❖ They provide support to plant body because of presence of ligin in its secondary cell walls. Lignin makes these walls thick and rigid.

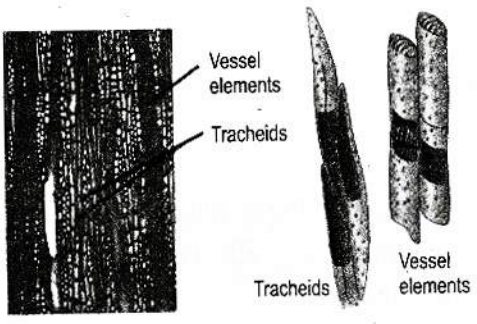


Figure 4.37: Xylem tissue

Types of Cell

Following types of cells are found in xylem tissues:

(a) Vessel Elements or Cells

❖ Vessel elements have thick secondary cell walls.

❖ They lack end walls and join together to form long tubes.

(b) Tracheids

❖ These are slender cells with overlapping ends.

Phloem Tissues **(Lahore board 2012 G I)**

Functions

They are responsible for the conduction of dissolved organic matter (food) between different parts of plant body.

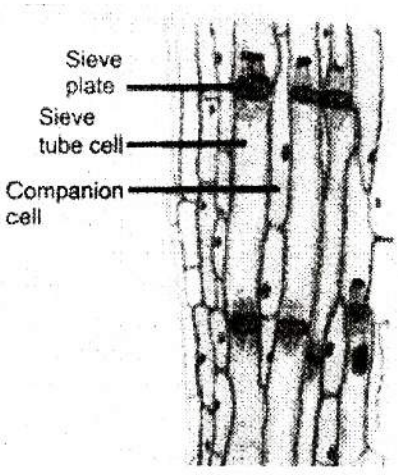


Figure 4.38: Phloem tissue

Types of Cells

Following types of cells are found in phloem tissues.

(a) Sieve tube cells:

- These are long cells and their end walls have small pores called sieve plates.
- Many sieve tube cells join to form long sieve tubes.

(b) Companion Cells:

Companion cells make proteins for sieve tube cells.

Multiple Choice Questions

1. Which of these clues would tell you whether a cell is prokaryotic or eukaryotic?
(a) The presence or absence of a cell wall.
(b) Whether or not the cell is partitioned by internal membranes.
(c) The presence or absence of ribosomes.
(d) Whether or not the cell contains DNA

2. There are _____ micrometers (μm) in one millimeter (mm).
(a) 10 (b) 100
(c) 1000 (d) $\frac{1}{1000000}$

3. The plasma membrane does all of these except _____.
(a) Contains the hereditary material.
(b) Acts as a boundary or border for the cytoplasm.
(c) Regulates passage of material in and out of the cell.
(d) Functions in the recognition of cell.

4. Which of these material is not a component of the plasma membrane?

(a) Lipids (b) Carbohydrates
(c) Proteins (d) DNA

5. Cell walls are found in these organisms, except for _____.
(a) Plants (b) Animals
(c) Bacteria (d) Fungi

6. The _____ is a major component of plant cell walls.
(a) Chitin (b) Peptidoglycan
(c) Cellulose (d) Cholesterol

7. Plant cells have _____ and _____ which are not present in animal cells.
(a) Milotochondria, Chloroplasts
(b) Cell membranes, cell walls
(c) Chloroplasts, nucleus
(d) Chloroplasts, cell wall

8. The _____ is the membrane-enclosed structure in eukaryotic cells that contains the DNA of the cell.
(a) Mitochondrion (b) Chloroplast
(c) Nucleolus (d) Nucleus

9. Ribosomes are constructed in the _____.
(a) Endoplasmic reticulum
(b) Nucleoid
(c) Nucleolus (d) Nuclear Pore

10. Rough endoplasmic reticulum is the area in a cell where _____ are synthesized.
(a) Polysaccharides (b) Proteins
(c) Lipids (d) DNA

11. Smooth endoplasmic reticulum is the area in a cell where_____are synthesized.
(a) Polysaccharides (b) Proteins
(c) Lipids (d) DNA

12. The mitochondrion function in
(a) Lipid storage (b) Protein synthesis
(c) Photosynthesis
(d) Cellular respiration

13. The thin extensions of the inner mitochondrial membrane are known as _____.
(a) Cristae (b) Matrix
(c) Thylakoids (d) Stroma

14. The chloroplast functions in _____.
(a) ATP synthesis (b) Protein synthesis
(c) Photosynthesis
(d) DNA replication

15. Which of these cellular organelles have their own DNA?
(a) Chloroplast (b) Nucleus
(c) Mitochondrion (d) All of these

16. Who described cells first?
(a) Robert Hooke (b) Leeuwenhook
(c) Robert Brown
(d) Schleiden & Schwann

17. Which one are the sites of protein synthesis?
(a) Nucleus (b) Mitochondria
(c) Endoplasmic Reticulum
(d) Ribosomes

18. The smallest cells of bacteria are called:
(a) Plasmodesmata
(b) Plasma membrane
(c) Mycoplasmas (d) Plasmolysis

19. Xylem and phloem tissues are examples of:

(a) Simple Tissues
(b) Compound tissues
(c) Meristematic Tissues
(d) None

20. Cellular eating is called:
(a) Pinocytosis (b) Endocytosis
(c) Phagocytosis (d) None

21. Which of the following movement requires energy in the form of ATP?
(a) Diffusion (b) Osmosis
(c) Active transport
(d) Facilitated diffusion
(Lahore board 2011 G II)

22. The example of bulkiest cells are:
(a) Bacteria (b) Bird eggs
(c) Muscle cells (d) Nerve cells

23. The example of long cells are:
(a) Bird eggs (b) Muscle cells
(c) Never cells
(d) Muscle cells & nerve cells

24. Human body is made up of how many types of cells?
(a) 200 (b) 300
(c) 400 (d) 500

25. Who reported that all animal tissues are also composed of individual cells?
(a) Robert Hooke
(b) Lorenz Oken (c) Robert Brown
(d) Schwann

26. Nucleus in the cell was discovered by:
(a) Robert Hooke (b) Lorenz Oken
(c) Robert Brown (d) Schwann

27. Cell theory was proposed by:
(a) Robert Hooke (b) Schwann
(c) Schleiden (d) Both a and b

28. Concept of "Omnis cellula e cellula" was given by:
(a) Robert Hooke (b) Lorenz Oken
(c) Robert Brown (d) Virchow

29. The cells used for transport of impulses are:
(a) muscles cells (b) nerve cells
(c) gland cells (d) RBC

30. The cells used for secretion of hormones are:
(a) muscles cells (b) nerve cells
(c) gland cells (d) RBCs

31. The cells used for support in plants are:
(a) Sclerenchymatous cells
(b) Collenchymatous cells
(c) Parenchymatous cells
(d) Both a and b

32. The cells used for photosynthesis in plants are:
(a) Sclerenchymatous cells
(b) Ground tissues
(c) Phloem tissues
(d) Meristematic cells

33. The cells used for storage in plants are:
(a) Sclerenchymatous cells
(b) xylem tissues
(c) Parenchymatous cells
(d) Meristematic cells

34. The cells which can divide in plants are:
(a) Sclerenchymatous cells
(b) Collenchymatous cells
(c) Parenchymatous cells
(d) Meristematic cells

35. The resolution of human eye is:
(a) 1.0 (b) 2.0
(c) 0.1 (d) 0.2

36. Magnification of electron microscope is:
(a) 2500 x (b) 25000 x
(c) 250000 x (d) None

37. The movement of molecules against the concentration gradient is called:
(a) Diffusion
(b) Passive transport
(c) active transport
(d) Endocytosis

38. Cellulose is present in:
(a) Primary wall
(b) Secondary wall
(c) Middle lamella
(d) None of the above

39. Lignin is present in:
(a) Primary wall
(b) Secondary wall
(c) Middle lamella
(d) None of the above

40. Lysosomes were discovered by:
(a) Sanger (b) Palade
(c) De Duve (d) Brown

41. The inner chamber of the mitochondria contains a fluid is called:
(a) Cristae (b) Matirx
(c) F_1 particles (d) None of the above

42. Which of the following are colourless and store starch, proteins and lipids?
(a) Chloroplasts
(b) Chromoplasts
(c) Leucoplasts
(d) None

43. The stacked membranous structure in the chloroplast is
(a) Thylakoids (b) Stroma
(c) Grana (d) Intergranum

44. The membranous structure in the chloroplast is:
(a) Thylakoids (b) Stroma
(c) Grana (d) Intergranum

45. The fluid within the chloroplast is:
(a) Thylakoids (b) Stroma
(c) Grana (d) Intergranum

46. The plastids present in fruits are:
(a) chloroplasts (b) Chromoplasts
(c) Leucoplasts (d) All of the above

47. The plastids present in roots are:
(a) chloroplasts (b) Chromoplasts
(c) Leucoplasts (d) All of the above

48. The structure present in the prokaryotes is:
(a) Mithochoridria (b) Ribosomes
(c) ER (d) Golgi bodies

49. Responsibility of protein synthesis is:
(a) Plastids (b) Ribosomes
(c) Golgi apparatus (d) Lysosomes
(Lahore board 2011 G II)

50. Polymer of amino acid and sugar is:
(a) Peptidoglycan (b) Glycolipids
(c) Phospholipids (d) Glycogen
(Lahore board 2011 G II)

51. Xylem tissues consist of vessel elements and:
(a) Sieve tube **(b) Tracheids**
(c) Mesophyll **(d) Fibre cell**
(Lahore board 2011 G I)

52. Primary cell wall of plants has a chemical:
(a) Cellulose (b) Peptidoglycan
(c) Glycolipids (d) Proteins
(Lahore board 2011 G I)

Answers

1.	b	**4.**	d	**7.**	d	**10.**	b	**13.**	a	**16.**	a	**19.**	B	**22.**	B
2.	c	**5.**	b	**8.**	d	**11.**	c	**14.**	c	**17.**	d	**20.**	C	**23.**	D
3.	a	**6.**	c	**9.**	c	**12.**	d	**15.**	c	**18.**	c	**21.**	C	**24.**	A
25	d	**26**	c	**27**	d	**28**	d	**29**	b	**30**	c	**31**	d	**32**	B
33	c	**34**	d	**35**	c	**36**	c	**37**	c	**38**	a	**39**	b	**40**	C
41	b	**42**	c	**43**	c	**44**	a	**45**	b	**46**	b	**47**	c	**48**	B
49	b	**50**	a	**51**	b	**52**	a								

Short Questions

Q:1. What is Active Transport?

Ans. Active transport is the movement of molecules from an area of lower concentration to the area of higher concentration. This movement against the concentration gradient requires energy in the form of ATP.

Q:2. Define Cell.

Ans. The structural and functional unit of living organisms is known as cell or cells are the smallest living things. It is the basic unit of organization of all organisms.

Q:3. What is Cell Membrane?

Ans. All prokaryotic and eukaryotic cells have a thin and elastic cell membrane covering the cytoplasm. Chemical analysis reveals that:

Cell membrane is mainly composed of proteins and lipids with small quantities of carbohydrates.

Cell membrane functions as a semi permeable barrier, allowing a very few molecules across it.

Q:4. Write salient features of Cell Theory.

Ans. It was presented by schleiden and shwann. The salient features of cell theory are:

i. All organisms are composed of one or more cells.
ii. Cells arise only by divisions in previously existing cells.
iii. Cells are the smallest living things, the basic unit of organization of all organisms.

Q:5. What is Cell Wall?

Ans. The cell wall is a non-living strong component of the cell and it is located outside the plasma membrane.

Plant cells have a variety of chemicals incorporated in their cell walls.

It provides shape, strength, protection and support to the inner living matter (Protoplasm) of the cell.

Q:6. Define Centriole.

Ans. Animals and many unicellular organisms have hollow and cylindrical organelles known as centrioles.

Their function is to help in the formation of spindle fibres during cell division. In the cells that contain cilia or flagella, centrioles are involved in the formation of cilia and flagella.

Q:7. What is Chloroplast?

Ans. Chloroplast is a type of plastid bound by a double membrane. It is found in plant cells. Chloroplasts are the sites of photosynthesis in eukaryotes. They contain chlorophyll, the green pigment necessary for photosynthesis.

Q:8. What is Chromoplast?

Ans. The second type of plastid in plant cells is chromoplast. They contain pigments associated with the bright colours and are present in the cells of flower petals and fruits. Their function is to give colour to their parts and thus help in pollination.

Q:9. What are Connective Tissues?

Ans. Connective tissue typically has cells scattered throughout an extra cellular matrix. Connective tissue serves a "Connecting" function. It supports and binds other tissues.

Q:10. What is Cytoplasm?

Ans. Cytoplasm is defined as the material between the plasma membrane (Cell membrane) and the nuclear envelope. It is a semi-viscous and semi-transparent substance. The cytoplasm of all the cell provides space for the proper functioning of the organelles and also acts as the site for various biochemical reactions.

Q:11. Define Diffusion.

Ans. Diffusion is the net movement of a substance from an area of higher concentration to the area of lower concentration i.e. along concentration gradient.

Q:12. What is Endoplasmic Reticulum?

Ans. It is a network of interconnected channels that extends from cell membrane to the nuclear envelope. RER serves a function in protein synthesis while SER involved in lipid metabolism and in the transport of materials from one part of the cell to the other.

Q:13. Define Epithelial Tissue.

Ans. Epithelial tissue covers the outside of the body and lines organs and cavities. The cells in this type of tissue are very closely packed together.

Epithelial tissue helps to protect the inner parts, movement of material and make secretions.

Q:14. Define Facilitated Diffusion.

Ans. It is a type of passive transport in which molecules are taken into or out of the cells with the help of transport proteins present in cell membranes. There is no expenditure of energy in this process.

Q:15. What are Golgi apparatus?

Ans. These are set of flattened sacs (cisternae) that are stacked over each other in plant and animal cells. It modifies molecules coming from rough ER and packs them into small membrane bound sacs. These sacs can be transported to various locations in the cell or to its exterior in the form of secretions.

Q:16. Define Hypertonic Solutions.

Ans. These are those solutions which have relatively more solute.

Q:17. Define Hypotonic Solutions.

Ans. These are those solutions which have relatively less solute.

Q:18. Define Isotonic Solutions.

Ans. Isotonic solutions have equal concentrations of solutes.

Q:19. What are Leucoplasts?

Ans. Leucoplasts are the third type of plastids. They are colourless and store starch, proteins and lipids. They are present in the cells of those parts where food is stored.

Q:20. Define Lysosomes.

Ans. These are single membrane bounded organelles. Lysosomes contain strong digestive enzymes and work for the breakdown (digestion) of food and waste materials within the cell.

Q:21. What is Mitochondrion?

Ans. Mitochondrion is the double membrane bounded structures found only in eukaryotes. These are the sites of aerobic respiration, and are the major energy production centre.

Q:22. What is Muscle Tissue?

Ans. Muscle tissue consists of bundles of long cells called muscle fibres. It is the most abundant tissue in a typical animal cell. The cells of this tissue have ability to contract.

Q:23. What do you know about Nucleus?

Ans. It is most important organelle of eukaryotic cells. In animal cells, it is present in the center while in a mature plant cells, due to the formation of large central vacuole, it is pushed to side. The nucleus is bounded by a double membrane known as nuclear envelope. Inside the nuclear envelope, a granular matrix, the nucleoplasm, one or two nucleoli and chromosomes are present. Nucleus controls all activities of cell.

Q:24. Define an Organelle.

Ans. These are small structures within the eukaryotic cells that perform specific functions e.g. mitochondrion, ribosomes, Golgi bodies, nucleus etc.

Q:25.Define Osmosis.

Ans. Osmosis is the movement of water across a semi-permeable membrane from a solution of lesser solute concentration to a solution of higher solute concentration.

Q:26.What is Passive transport?

Ans. It is a type of transport in which a cell does not spend energy when molecules moves across its membrane from a region of higher concentration to a region of lower concentration.

Q:27. Define Phagocytois (cellular eating).

Ans. It is a form of endocytosis in which cell takes in solid material.

Q:28. Define Pinocytosis (Cellular Drinking).

Ans. It is a form of endocytosis in which cell takes in liquid in the form of droplets.

Q:29. What is Plasmolysis?

Ans. In a hypertonic environment, a plant cell loses water, causing the cytoplasm to shrink within the cell wall. The shrinking of cytoplasm is called plasmolysis.

Q:30. What are Plastids? **(Lahore board 2011 G II)**

Ans. Plastids are also membrane bounded organelles that only occur in plants and photosynthetic protists (algae). They are of three types i.e. chloroplasts, leucoplasts and chromoplasts. Chloroplasts are the sites of photosynthesis while chromoplasts help in pollination and dispersal of fruits and leucoplast help in storage.

Q:31. What are Ribosomes? **(Lahore board 2011 G I)**

Ans. Ribosomes are tiny granular structures that are either floating freely in the cytoplasm or are bound to the endoplasmic reticulum (ER). Ribosomes are the sites of protein synthesis.

Q:32. Define semi-permeable Membrane.

Ans. It is a membrane which allows a very few molecules across it while fencing the majority of chemicals inside the cell.

Q:33. What is Tissue?

Ans. A group of cells specialized for the performance of a common function is called a tissue

Q:34. What is Turgor Pressure?

Ans. When cell is placed in a hypotonic environment, water is entered in the cell and makes the cell rigid. The internal pressure of such a rigid cell on the cell wall by the water is known as turgor pressure and this phenomenon is known as turgor.

Q:35. Define Vacuole.

Ans. Vacuoles are fluid filled single membrane bounded organelles. They are of different types. They help to digest the material with the help of lysosomes and elimination of wastes from their bodies.

Q:36. Define Microfilament.

Ans. Microfilament is one of the most important filament that make up the cytoskeleton. It is made of actin subunits. These are often used by cells to change their shapes and to hold structures.

Q:37. Define Microtubule.

Ans. Microtubule is another most important filament that make up the cytoskeleton. It is made of tubulin subunits and are often used by cells to hold their shape.